Argonne National Laboratory's Experience in Decontamination and Decommissioning (D&D) of Nuclear Facilities

The Argonne National Laboratory (ANL) D&D Projects Group has the unique experience required to facilitate and support the safe and timely implementation of decommissioning. The following sections describe Argonne's specific decommissioning experience.

Argonne D&D Expertise

Argonne's D&D group has become subject matter experts in the areas indicated below through their hands-on experiences obtained over the last 25 years in decommissioning research reactors and nuclear facilities at Argonne National Laboratory and other sites abroad. These areas of expertise are often required during a decommissioning project:

1. Project Management and Execution including Cost, Schedule, Quality and Technical baseline management.
2. Plan Preparation and Reviews (Decommissioning Plan, Radiation Protection, Characterization Plan, Health & Safety, Quality Assurance Plan).
3. Project Readiness Reviews and Walkdowns
4. Project Health Physics and Industrial Safety Oversight.
5. NRC Licensing Activities.
6. Quality Assurance Audits and Assessments
7. D&D Training for all levels of personnel.

Argonne National Laboratory proposes working with the customer to gain agreement on where Argonne National Laboratory's D&D expertise could most effectively be utilized in planning and executing the safe and efficient decommissioning of their specific facility or facilities.

Argonne's D&D Projects Group Experience

ANL's Nuclear Engineering Division, through its D&D Projects Group, has been leading and supporting the decommissioning of nuclear facilities at ANL and at various other locations within the United States and abroad for over 25 years. For the Argonne nuclear facilities, the work was conducted under D&D Projects Group direction and the knowledge gained and the lessons learned were applied to subsequent projects. Some hands-on decommissioning work was performed using Argonne's in-house labor forces while other projects were done with contractor work forces. The list below illustrates the extent of the decontamination and decommissioning work that the group has performed.

Argonne National Laboratory Decommissioning Projects
Argonne research facilities decommissioned include:

- **Experimental Boiling Water Reactor (EBWR)**
- **Chicago Pile 5 (CP-5) Research Reactor**
- **JANUS Biological Reactor Facility**
- **Argonne Thermal Source Reactor (ATSR)**
- **Building 212 Plutonium Gloveboxes**
- **Building 200 M-Wing Hot Cells (decontaminated for safe storage)**
- **Building 301 Hot Cells (characterized awaiting funding)**
- **Experimental Breeder Reactor-II (EBR-II) (placed in safe storage)**
- **Small-scale D&D projects**

The following is a brief description of some of ANL's decommissioning projects and experience:

Experimental Boiling Water Reactor (EBWR)
EBWR was a 100 MW proof of concept research reactor built in 1957, and subsequently shut down and placed in a dry lay-up condition in 1967. As part of the dry lay-up, all the reactor fuel was removed and shipped to the DOE Savannah River Plant. All reactor systems were flushed and drained. Several of the outbuildings were either demolished or converted for reuse prior to 1980. Decontamination and decommissioning of EBWR began in 1986 and was completed in February 1996 under DOE ANL direction at a total cost of $19.5M.

Chicago Pile 5 (CP-5) Research Reactor
The Chicago Pile No. 5 (CP-5) Research Reactor Facility was used to perform a variety of Laboratory research experiments, using the reactor as a neutron source. During its lifetime, the reactor was used to irradiate over 27,000 research specimens. The decommissioning of CP-5 was initiated in 1990 and completed in July 2000.

The CP-5 Facility was chosen by DOE as the best site for a Large Scale Demonstration Project (LSDP) to select the best and most innovative "field test ready" D&D technologies for demonstration in a large-scale demonstration environment. The LSDP was conducted by the Strategic Alliance for Environmental Restoration.

JANUS Biological Reactor Facility
The JANUS Facility was used as a neutron source to research the biological and genetic effects of acute and chronic exposures to neutrons arising from the fission process. The facility operated from 1963 to 1992 at power levels up to 200 kW. The D&D project was completed in 1997 under DOE ANL direction at a cost of $2.1M. The project was completed on time, under budget, with no lost time accidents or radiological incidents.

Argonne Thermal Source Reactor (ATSR)
The ATSR, a highly enriched, light water-moderated thermal reactor, operated from 1953 to 1988 and served as a source of neutrons for ANL experimental research programs. This reactor was utilized for physics testing and in the development of nuclear instrumentation. The project was completed in October 1998 under DOE ANL direction at a cost of $650k with no lost time accidents or radiological incidents.

Building 212 Plutonium Glovebox Project
Nine laboratories in Building 212 were used from 1960's to 1989 for research on nuclear reactor fuel development and for determination of actinide metal properties. The fuels development was accomplished in 61 plutonium gloveboxes. The project was initiated in 1992 to characterize and decommission these gloveboxes to eliminate the risk of release of plutonium and to make the space available for beneficial reuse. The work was started in 1992 and completed in 1996 with the duration of the physical work taking 39 months. The gloveboxes were decontaminated, size reduced, and then shipped for disposal as low-level radioactive waste. Transuranic waste generated from this project was placed into storage on site pending the opening of the Waste Isolation Pilot Plant. The total project cost was $6.9M.

Building 200 M-Wing Hot Cells
Five hot cells in the Building 200 M-Wing were used for a U.S. Navy Proof of Breeding (POB) research program, which was part of a U.S. Department of Energy (DOE) effort to develop technology for breeding uranium-233 from thorium-232 in light water reactors. The research work with irradiated blanket fuel pins from the Shippingport Reactor was completed in 1985. The decontamination project (the facility was not decommissioned only decontaminated for safe storage and to reduce radon emissions) was completed in 1996 at a cost of $5.8M.

Building 301 Hot Cells
Building 301 contains eight caves that were used to perform a variety of early radiological research experiments for the DOE. The hot cells were placed into use in the early 1950's and were phased out in 1971. The cells received some preliminary cleanup, but fixed low-level residual contamination remains. The D&D project is currently on hold until sufficient funding is obtained to complete the project.

Experimental Breeder Reactor – II
The Experimental Breeder Reactor – II was a 62.5 MWt research and test reactor located in Idaho. It was commissioned in 1961 and operated for 33 years until it was shutdown in 1994. The reactor fuel was subsequently removed and stored. Personnel at Argonne National Laboratory-East supported development of the safety basis to drain the sodium from the reactor and developed and demonstrated a "passivation" process for treating the residual sodium located in the primary and

secondary systems. Currently, the EBR-II reactor is in a safe storage configuration with all primary and secondary systems drained of sodium, a passivation layer consisting of sodium bicarbonate exists on exposed sodium surfaces, and all primary and secondary systems inerted with a cover gas blanket. Full D&D of the facility will be resumed when necessary funding is obtained.

Small-Scale Decommissioning Projects

The ANL D&D group has been managing numerous smaller-scale D&D projects including decommissioning a 5,000 sq ft kennel facility, multiple glovebox facilities, and plutonium contaminated equipment.

D&D Support to Outside Customers

Argonne National Laboratory's D&D Projects Group has been providing D&D support to other DOE organizations (e.g., Tokomak Fusion Test Reactor at Princeton Plasma Physics Laboratory, Los Alamos National Laboratory, Brookhaven National Laboratory, Savannah River Site, Mound, Hanford N Reactor, and West Valley) and to non-DOE organizations, e.g., the decommissioning of a research reactor at NASA's Plum Brook Research Facility as well as for the U.S. Army. Specifically, a team of Argonne National Laboratory D&D experts have been stationed at the Plum Brook Research Facility for more than 4 years providing direct technical support to NASA in the areas of construction management, radiation safety, licensing and quality assurance oversight, and industrial safety. In addition, two D&D training courses were developed and taught at the NASA project site, several years apart, as part of the training of newly assigned project personnel.

The D&D Project Group has been conducting D&D training for over eight years. More than 20 in-depth training courses (ranging in length from 1-2 days to 3-weeks) have been conducted for national and international trainees on the decommissioning of nuclear facilities. The courses have focused on various types of contaminated facilities – research reactors, hot cells, glovebox facilities, production reactors, waste management facilities, and other non-nuclear facilities. To date, over 750 participants from over 40 countries have participated in these training courses. The training course has been given at various U.S and international locations and at customer's sites.